

CATALOG DOCUMENTATION
MAIA-ESTUARIES SUMMARY DATABASE
1997 and 1998 STATIONS
BENTHIC TAXON ABUNDANCE DATA: "BEN_ABUN"

TABLE OF CONTENTS

1. DATASET IDENTIFICATION
2. INVESTIGATOR INFORMATION
3. DATASET ABSTRACT
4. OBJECTIVES AND INTRODUCTION
5. DATA ACQUISITION AND PROCESSING METHODS
6. DATA MANIPULATIONS
7. DATA DESCRIPTION
8. GEOGRAPHIC AND SPATIAL INFORMATION
9. QUALITY CONTROL AND QUALITY ASSURANCE
10. DATA ACCESS AND DISTRIBUTION
11. REFERENCES
12. TABLE OF ACRONYMS
13. PERSONNEL INFORMATION

1. DATASET IDENTIFICATION

- 1.1 Title of Catalog document
MAIA-Estuaries Summary Database
1997 and 1998 Stations
Benthic Taxon Abundance Data
- 1.2 Authors of the Catalog entry
John Kiddon, U.S. EPA NHEERL-AED
Harry Buffum, OAO Corp.
- 1.3 Catalog revision date
April 30, 2000
- 1.4 Dataset name
BEN_ABUN
- 1.5 Task Group
MAIA Estuaries
- 1.6 Dataset identification code
009
- 1.7 Version
001
- 1.8 Request for Acknowledgment
EMAP requests that all individuals who download EMAP data acknowledge the source of these data in any reports, papers, or presentations. If you publish these data, please include a statement similar to: "Some or all of the data described in this article were produced by the U. S. Environmental Protection Agency through its Environmental Monitoring and Assessment Program (EMAP)".

2. INVESTIGATOR INFORMATION (for full addresses see Section 13)

2.1 Principal Investigators

John Paul, U.S. Environmental Protection Agency, NHEERL-Atlantic Ecology Division (AED)
Charles Strobel, U.S. Environmental Protection Agency, NHEERL-Atlantic Ecology Division (AED)

2.2 Sample Collection Investigators

Charles Strobel, U.S. Environmental Protection Agency, NHEERL-Atlantic Ecology Division (AED)
John Macauley, U.S. Environmental Protection Agency, Gulf Ecology Division (GED)
Jeffrey L. Hyland, National Oceanographic and Atmospheric Admin.-Carolinian Province (NOAA-DB)
Michelle Harmon, National Oceanographic and Atmospheric Admin.-Delaware Bay (NOAA-DB)
Carl Zimmerman, National Park Service (NPS)
Dan Dauer, Chesapeake Bay Program, Old Dominion University (CBP-ODU)
J. Ananda Ranasinghe, Chesapeake Bay Program, Versar, Inc. (CBP-VER)

2.3 Sample Processing Investigators

J. Ananda Ranasinghe, Chesapeake Bay Program, Versar, Inc. (CBP-VER)

3. DATASET ABSTRACT

3.1 Abstract of the Dataset

The BEN_ABUN file reports the identity and abundance of benthic species found in grab samples collected in MAIA estuaries during the Summers of 1997 and 1998. One record is presented for each taxon per grab at a station. Each record includes the taxonomic name that was assigned by the partner responsible for the analysis (TAX_DSCR), and an additional codename (TAXNCODE) assigned to provide consistency despite different naming conventions employed by partners. The abundance of each taxa is reported, as well as a parameter that specifies the taxonomic level represented by the record, *i.e.*, species, genus, family, *etc.*, and the number of grabs collected at a site (one, two, or three).

3.2 Keywords for the Dataset

Benthic species, taxa, invertebrates, community composition, taxonomic identity, abundance per grab, epifaunal, infaunal

4. OBJECTIVES AND INTRODUCTION

4.1 Program Objective

The main objectives of the MAIA-Estuaries program are: (1) to evaluate the ecological condition of the Mid-Atlantic estuaries by measuring key properties of the water, sediment, and the community of organisms; (2) to focus attention on small estuaries in order to develop better monitoring approaches for these critical systems; and (3) to develop partnerships among federal and state environmental organizations.

The Environmental Monitoring and Assessment Program (EMAP) is an EPA research and monitoring program designed to provide unbiased assessments of the condition of selected resources over a wide region. A key feature of the program is a probabilistic sampling strategy that randomly selects sampling sites and assigns weighting factors based on area to all measured results. EMAP's strategy was adopted by the Mid-Atlantic Integrated Assessment (MAIA) program, which was designed to assess the conditions of the estuaries, forests, streams and lakes, and agricultural lands in the eight-state Mid-Atlantic region. This file contains data measured in MAIA estuaries during the Summers of 1997 and 1998. Samples were collected for water and sediment analyses primarily in 1997, with a few additional sites sampled in 1998. Fish samples were collected

only in 1998. Several estuaries were designated as intensive sites and were sampled in greater detail (see STATIONS file).

The partners in MAIA-Estuaries program are: (1) The U.S. Environmental Protection Agency (USEPA), including both the Atlantic Ecology Division (AED) and the Gulf Ecology Division (GED); (2) National Park Service (NPS) under their project "Maryland Coastal Bays Monitoring"; (3) National Oceanographic and Atmospheric Administration (NOAA) which conducted sampling both in the Delaware Bay (DB) under their "National Status and Trends Program" and in the Carolinian Province (CP); and (4) The Chesapeake Bay Program (CBP), which is a consortium of federal, state, and local governments and nongovernmental organizations. Each partner was responsible for collecting, processing, and reviewing data. The USEPA Atlantic Ecology Division was responsible for final assembly and review of all data. Laboratories contracted to process samples are specified by the parameter LABCODE included in all data files (Section 4.4). Details regarding use of partner and LABCODE information are presented in the EVENTS metadata file.

4.2 Dataset Objective

The identity and abundance of the benthic organisms are reported for each grab sample collected.

4.3 Dataset Background Discussion

Benthic invertebrates constitute the largest living reservoir of organic carbon in many estuarine systems. Most of the organisms are secondary consumers in the estuarine food web, and in turn are prey for fish and other organisms. They are generally long-lived, relatively immobile, and are believed to be sensitive to stresses such as alteration of habitat, exposure to toxic substances and low-oxygen conditions, *etc.* For these reasons, monitoring programs often collect information about the identity, abundance and biomass of benthic organisms. Such data are used to develop indices of abundance and diversity which help characterize the ecological condition of an estuary.

Only the identity and abundance data are reported in this file; biomass data are reported in the BEN_BIOM file. Note several features of these data files:

(1) At about half the stations, a single grab sample was. At the remaining stations, either two or three grab samples were processed. Care should therefore be taken when calculating and comparing indices that are affected by the number of grab samples taken at a site, *e.g.*, abundance or richness indices. The parameter BENGGRAB identifies the grab sample associated with the record (either 1, 2, or 3), and is reported consistently in the BEN_ABUN, BEN_BIOM, and BENGRAB data files.

(2) Three parameters contain information about the identity of the organism: (i) TAX_DSCR is the taxonomic name as provided by the partner conducting the survey. Occasionally, the name may differ from the standard Latin name recognized by taxonomist because of slightly different naming conventions used by the partners, or because of misspellings, the incorporation of descriptive information, *etc.* These names are retained in this file as a connection to the original databases. (ii) TAXNCODE is a eight-character codename for the taxon identified in the record. The codenames are consistent among partners and provide an informed best-guess in the case of ambiguous assignments. Use this name rather than TAX_DSCR when analyzing abundance and biomass data. The proper Latin name associated with the codename is listed in a separate data file BEN_TAXA. (iii) While most taxa are identified to the species level, some are reported only to the genus, family or higher level. The parameter ID_LEVEL reports the taxonomic level represented by the record. This information may be helpful to avoid double-counting the number of species in a grab sample.

4.4 Summary of Dataset Parameters

*STATION	Station name
*EVNTDATE	Event date
*BENGRAB	Identifier for grab sample at a station. Either 1, 2, or 3 grabs were collected at a site. This parameter identifies the specific grab sample associated with a taxon.
*TAXNCODE	Codename assigned to each taxon to minimize variations in names arising from different naming conventions employed by partners. There is a one-to-one correspondence between the codename and the proper Latin name, as is listed in the BEN_TAXA file.
ABUNDANC	Number of organisms of a taxon found in a grab sample
ID_LEVEL	Taxonomic level represented by the taxa (<i>i.e.</i> , species, genus, family, <i>etc.</i>)
TAX_DSCR	Name of taxon as reported by partner conducting survey. The name may contain descriptive phrases in addition to a Latin name, and naming conventions vary slightly among partners.
LABCODE	A code identifying the partner or contract responsible for analyzing samples BEN-1 USEPA contractor: Versar, Inc. BEN-2 NOAA Carolinian Province contractor BEN-3 Chesapeake Bay Program contractor: Versar, Inc. BEN-4 NOAA Delaware Bay contractor
QACODE	QA/QC codes <blank> No qualification
YEAR	Year of Sampling 1997 or 1998

* denotes parameters that should be used as key fields when merging data files

5. DATA ACQUISITION AND PROCESSING METHODS

5.1 Data Acquisition

The sample collection methods used by USEPA field crews will be described here. Any significant variations by other MAIA partners are noted in Section 5.1.12. Details regarding MAIA partners are reported in the EVENTS data file.

5.1.1 Sampling Objective

Benthic grab samples were collected for the identification and enumeration of benthic organisms and subsequent determination of ash-free dry weight (biomass) and grain size.

5.1.2 Sample Collection: Methods Summary

One to three replicate 'grab' samples were collected from each station using a Young-modified Van Veen grab sampler. Each replicate grab was assigned an identification number (1, 2, or 3) that is reported as the BENGRAB parameter in this and other data files. The grabs were nominally 440 cm² in area and 10 cm deep. A sub-sample 2.5 cm in diameter and the depth of the grab was taken from each grab for grain-size analysis. The remaining sediments were live-sieved in the field with a 0.5 mm mesh screen. Organisms retained on the screen were placed in plastic containers and fixed in 10% buffered formalin with rose bengal stain for preservation.

5.1.3 Beginning Sampling Dates

8 July 1997
13 July 1998

5.1.4 Ending Sampling Dates

8 October 1997
8 October 1998

5.1.5 Sampling Platform

Samples were collected from gasoline or diesel powered boats, 18 to 133 feet in length

5.1.6 Sampling Equipment

A 1/25 m², stainless steel (coated with Kynar), Young-modified Van Veen grab sampler was used to collect sediments

5.1.7 Manufacturer of Sampling Equipment

Young's Welding, Sandwich, MA

5.1.8 Key Variables

Not applicable

5.1.9 Sample Collection: Calibration

The sampling gear does not require any calibration, although it was inspected regularly for damage by mishandling or impact on rocky substrates.

5.1.10 Sample Collection: Quality Control

Care was taken to minimize disturbance to the sediment grabs. Grabs that were incomplete, slumped, less than 7 cm in depth, or comprised chiefly of shelly substrates were discarded. The chance of sampling the same location was minimized by repositioning the boat (five meters downstream) after three sampling attempts.

5.1.11 Sample Collection: References

Strobel, C.J. 1998. Environmental Monitoring and Assessment Program - Mid-Atlantic Integrated Assessment. Estuaries Component, Field Operations and Safety Manual. U.S. EPA, Office of Research and Development, NHEERL-AED, Narragansett, RI. July 1998.

Kokkinakis, S.A., J.L. Hyland, and A. Robertson. 1994. Carolinian Demonstration Project - 1994 Field Operations Manual. Joint National Status and Trends/Environmental Monitoring and Assessment Program. NOAA/NOS/ORCA, Silver Spring, MD.

5.1.12 Sample Collection: Alternate Methods

Not applicable

5.2 Data Preparation and Sample Processing

The processing methods used by USEPA contracts will be described here (LABCODE = BEN-1). Any significant variations by other MAIA partners are noted in Section 5.2.6.

5.2.1 Sample Processing Objective

To identify and count all infaunal and epifaunal organisms present in benthic grab samples.

5.2.2 Sample Processing: Methods Summary

All taxa in a grab sample were sorted by a technician and then identified and counted by a skilled taxonomist. Either 1, 2, or 3 grabs were collected at a station, and each grab was processed separately. Only organisms larger than 0.5 mm were processed; therefore groups such as turbellarian flatworms, nematodes, ostracods, harpacticoid copepods and foraminifera were excluded from the identification process. Because of complexities involved with precise identification, the following groups of organisms were routinely identified to the indicated taxonomic level: anthozoa (class), chironomidae (family), hirudinea (class), nemertinea (phylum), oligochaeta (class), ostracoda (subclass), sipuncula (phylum), turbellaria (class), and copepoda (order). Occasionally, the taxonomist amended the Latin name with descriptive phrases such as "complex", "group", "with capiliform chaetae", etc. These original names are reported in the parameter TAX_DSCR. To provide consistency among partners, a codename

(TAXNCODE) was assigned to the records, using best judgement in ambiguous cases. The standard Latin names and ISTN codes associated with the TAXNCODEs are contained in the file BEN_TAXA. Additionally, the taxonomic level represented by the name is specified in the parameter ID_LEVEL. This information may help an analyst when counting the number of unique species in a grab, for instance. Following identification, all specimens were either archived in a reference collection or ashed to determine biomass.

5.2.3 Sample Processing: Calibration

Not applicable

5.2.4 Sample Processing: Quality Control

A minimum of 10% of all samples sorted by each technician were resorted to monitor performance and provide feedback to maintain acceptable standards. Only skilled taxonomists conducted the organism identification. A minimum of 10% of samples were re-checked by other qualified taxonomists for accuracy in identification and enumeration. Species lists from different labs were cross-checked. Inconsistencies in nomenclature were corrected as necessary.

5.2.5 Sample Processing: References

U.S. EPA. 1995. Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual-Estuaries, Volume 1: Biological and Physical Analyses. Narragansett (RI): U.S. Environmental Protection Agency, Office of Research and Development, EPA/620/R-95/008.

5.2.6 Sample Processing: Alternate Methods

Not applicable

6. DATA ANALYSIS AND MANIPULATIONS

6.1 Name of New or Modified Values

Not applicable

6.2 Data Manipulation Description

Not applicable

7. DATA DESCRIPTION

7.1 Description of Parameters

7.1.1 Components of the Dataset

<u>VARIABLE</u>	<u>TYPE</u>	<u>LEN</u>	<u>LABEL</u>
STATION	Char	10	Station name
EVNTDATE	Num	8	Event date
BENGRAB	Num	8	Identifier for replicate grabs at a station
TAXNCODE	Char	8	Taxon code name
ABUNDANC	Num	8	Species abundance in grab sample
ID_LEVEL	Char	8	Taxon taxonomic level
TAX_DSCR	Char	50	Taxon Latin name
LABCODE	Char	5	Contract/Lab identifier
QACODE	Char	10	QA/QC code
YEAR	Num	4	Year of Sampling

7.1.2 Precision of Reported Values

Abundance counts are reported as whole numbers

7.1.3 Minimum Value in Dataset

BENGRAB	1
ABUNDANC	0

7.1.4 Maximum Value in Dataset

BENGRAB	3
ABUNDANC	3412

7.2 Data Record Example

7.2.1 Column Names for Example Records

STATION	EVNTDATE	BENGRAB	TAXNCODE	ABUNDANC
ID_LEVEL	TAX_DSCR	LABCODE	QACODE	YEAR

7.2.2 Example Data Records

STATION	EVNTDATE	BENGRAB	TAXNCODE	ABUNDANC
MA97-0001	8/25/97	1	ACTECANA	1
MA97-0001	8/25/97	1	ANTHOZOA	1
MA97-0001	8/25/97	1	CAPICAPI	34
MA97-0001	8/25/97	1	HETEFILI	15
MA97-0001	8/25/97	1	MERCMERC	2

ID_LEVEL	TAX_DSCR	LABCODE	QACODE	YEAR
SPECIES	Acteocina canaliculata	.	BEN-1	1997
CLASS	Anthozoa	.	BEN-1	1997
SPECIES	Capitella capitata complex	.	BEN-1	1997
SPECIES	Heteromastus filiformis	.	BEN-1	1997
SPECIES	Mercenaria mercenaria	.	BEN-1	1997

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude (Westernmost)

-77.4339 decimal degrees

8.2 Maximum Longitude (Easternmost)

-74.7230 decimal degrees

8.3 Minimum Latitude (Southernmost)

34.9670 decimal degrees

8.4 Maximum Latitude (Northernmost)

40.1470 decimal degrees

8.5 Name of area or region

MAIA estuary region, consisting of Delaware Bay, Chesapeake Bay, the Delmarva coastal bays, Albemarle-Pamlico Sound, and contiguous estuaries.

9. QUALITY CONTROL AND QUALITY ASSURANCE

9.1 Measurement Quality Objectives

The measurement quality objectives of the EMAP-Estuaries program specifies that sorting, counting and identification procedures be accurate to within 10% (see Valente and Strobel, 1993).

9.2 Data Quality Assurance Procedures

A minimum of 10% of all samples processed were resorted by a second qualified technician. A minimum of 10% of all samples processed by each taxonomic technician was checked by a second senior taxonomist to verify the accuracy of species identification and enumeration.

9.3 Actual Measurement Quality

Results of QA checks performed on samples processed by USEPA contractor (LABCODE = BEN-1):

	Sorting	Species ID & Enumeration
# Samples Processed	490	490
# Samples Rechecked	50	46
Average Error	1.70%	2.00%
Range of Error	0 - 9.1%	0 - 9.7%

These checks meet the criteria listed in Section 9.2.

10. DATA ACCESS

10.1 Data Access Procedures

Data can be downloaded from the web

10.2 Data Access Restrictions

None

10.3 Data Access Contact Persons

John Paul, Principal Investigator
U.S. EPA NHEERL-AED
401-782-3037, 401-782-3099 (FAX), paul.john@epa.gov

Harry Buffum, Data Manager/ MAIA-Estuaries
U.S. EPA NHEERL-AED
401-782-3183, 401-782-3030 (FAX), buffum.harry@epa.gov

10.4 Dataset Format

ASCII (CSV) and SAS Export files

10.5 Information Concerning Anonymous FTP

Not available

10.6 Information Concerning WWW

See Section 10.1 for WWW access

10.7 EMAP CD-ROM Containing the Dataset

Data not available on CD-ROM

11. REFERENCES

- Hyland, J., Baptiste, E., Campbell, J., Kennedy, J., Kropp, R., and Williams, S. 1991. Macroinfaunal communities of the Santa Maria Basin on the California outer continental shelf and slope. *Mar. Ecol. Prog. Ser.* 78:147-161.
- Kokkinakis, S.A., Hyland, J.L., and Robertson, A. 1994. Carolinian Demonstration Project - 1994 Field Operations Manual. Joint National Status and Trends/Environmental Monitoring and Assessment Program. NOAA/NOS/ORCA, Silver Spring, MD.
- Salonen, K. 1979. A versatile method for the rapid and accurate determination of carbon by high temperature combustion. *Limnol. Oceanogr.* 24: 1770-183.
- Strobel, C.J. 1998. Environmental Monitoring and Assessment Program - Mid-Atlantic Integrated Assessment. Estuaries Component, Field Operations and Safety Manual. U.S. EPA, Office of Research and Development, NHEERL-AED, Narragansett, RI. Forthcoming.
- Strobel, C.J. 1998. Mid Atlantic Integrated Assessment / Environmental Monitoring and Assessment Program - Estuaries: Virginian Province Quality Assurance Project Plan. U.S. EPA, Office of Research and Development, NHEERL-AED, Narragansett, RI. June 1998.
- Texas A & M University, Geochemical and Environmental Research Group. 1990. NOAA Status and Trends, Mussel Watch Program, Analytical Methods. Submitted to NOAA. Rockville (MD): U.S. Dept. of Commerce, National Oceanic & Atmospheric Administration, Ocean Assessment Division.
- U.S. EPA. 1995. Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual-Estuaries, Volume 1: Biological and Physical Analyses. U.S. Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/620/R-95/008.
- Valente, R. and Strobel, C.J. 1993. Environmental Monitoring and Assessment Program- Estuaries: 1993 Virginian Province Quality Assurance Project Plan. U.S. EPA, NHEERL-AED, Narragansett, RI. May 1993
- Weston, D.P. 1988. Macrobenthos-sediment relationships on the continental shelf off Cape Hatteras, North Carolina. *Contin. Shelf Res.* 8:267-286.

12. TABLE OF ACRONYMS

AED	Atlantic Ecology Division
CP	Carolinian Province
CBP	Chesapeake Bay Program
DB	Delaware Bay
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
GED	Gulf Ecology Division
GERG	Geochemical and Environmental Research Group
MAIA	Mid-Atlantic Integrated Assessment
NHEERL	National Health and Environmental Effects Research Laboratory
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPS	National Park Service
ODU	Old Dominion University
ORCA	Office of Ocean Resources Conservation and Assessment

12. TABLE OF ACRONYMS, continued

ORD	Office of Research and Development
QA/QC	Quality Assurance/Quality Control
TAMU	Texas A&M University
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
VER	Versar, Inc.
WWW	World Wide Web

13. PERSONNEL INFORMATION

Harry Buffum, Database Manager, OAO Corp.
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3183, 401-782-3030 (FAX), buffum.harry@epa.gov

Don Cobb, Chemist
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-9616, 401-782-3030 (FAX), cobb.donald@epa.gov

Dan Dauer, Dept. of Biological Sciences
Old Dominion University, Norfolk, VA 23529-0266
757-683-3595, 757-683-5283 (FAX), ddauer@odu.edu

Courtney T. Hackney, Dept. of Biological Sciences
University of North Carolina at Wilmington, Wilmington, NC 28403-3297
910-962-3759, hackney@uncwil.edu

Steve Hale, EMAP Information Manager
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3048, 401-782-3030 (FAX), hale.stephen@epa.gov

Michelle Harmon, Program Manager
NOAA/NOS
1305 East West Highway, 10200 SSMC4, Silver Spring, MD 20901-3281
301-713-3034 x619, 301-713-4388 (FAX), michelle.harmon@noaa.gov

Melissa M. Hughes, Data Librarian, EMAP-Estuaries
OAO Corp., U.S. EPA NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3184, 401-782-3030 (FAX), hughes.melissa@epa.gov

Jeffrey L. Hyland, Carolinian Province Manager
NOAA/NOS/ORCA/CMBAD, NOAA/EPA Joint Nat. Coastal Research and Monitoring Program
217 Fort Johnson Rd. (P.O. Box 12559), Charleston, SC 29422-2559
843-762-5415, 843-762-5110 (FAX), jeff.hyland@noaa.gov

John Kiddon, AED Oceanographer
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3044, 401-782-3030 (FAX), kiddon.john@epa.gov

Joe LiVolsi, AED QA Officer
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3163, 401-782-3030 (FAX), livolsi.joseph@epa.gov

John Macauley, Field Coordinator
U.S. Environmental Protection Agency, NHEERL-Gulf Ecology Division (GED)
One Sabine Island Drive, Gulf Breeze, FL 32561
850-934-9200, 850-934-9201 (FAX), macauley.john@epa.gov

John Paul, Principal Investigator
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3037, 401-782-3099 (FAX), paul.john@epa.gov

J. Ananda Ranasinghe, Program Manager
Versar, Inc.
9200 Rumsey Rd., Columbia, MD 21045-1934
410-964-9200, 410-964-5156 (FAX), ranasinghana@versar.com

Charles J. Strobel, Field Coordinator
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3180, 401-782-3030 (FAX), strobel.charles@epa.gov

Carl S. Zimmerman, Chief, Division of Resource Management
Assateague Island National Seashore
7206 National Seashore Lane, Berlin, MD 21811
410-641-1443 x213, 410-641-1099 (FAX), carl_zimmerman@nps.gov